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RESEARCH ARTICLE

Neglected landraces of collard (*Brassica oleracea* L. var. *viridis*) from the Carolinas (USA)

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Abstract A common garden crop grown in the coastal plain region of North and South Carolina (United States) is the non-heading, leafy green type of *Brassica oleracea* L. known as collard (*B. oleracea* L. subsp. *oleracea* convar. *acephala* (DC.) Alef. var. *viridis* L.). Predominantly a fall and winter vegetable in this region, collard is often the only green planting to be found in the yard or garden of a rural home during these cool seasons. Historically, the traditional collard patch and even commercial fields were planted with unique varieties perpetuated by individual seed savers, and collectively, the regional diversity for this crop was probably very significant for well over a century. Genetic erosion of this collard germplasm pool has been severe in recent decades as commercial hybrids have been adopted by both large-scale producers and home gardeners. Although a significant number of collard landraces are being perpetuated to this day, existing diversity among landraces still grown in the region is now in the hands of an aging population of seed savers who maintain germplasm through on-farm preservation. From 2003 to 2006, we explored the coastal plain region of North and South Carolina in search of collard gardens containing traditional landraces. Exploration trips were conducted mid-winter to early spring. About 90 samples of collard were obtained from seed savers during the course of this exploration. Observations of morphological differences of these landraces indicate that significant diversity exists in this group. Obtained landraces are being deposited into the U.S. plant introduction collection and will be available for future use. This preserved collection could prove to be an important new source of genes for *B. oleracea* improvement.

Keywords Acephala Group · *B. oleracea* L. subsp. *oleracea* convar. *acephala* (DC.) Alef. var. *viridis* L. · Landraces · Leafy green · On-farm preservation

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The coastal plain region of North and South Carolina is a U.S. center of genetic diversity for the non-heading *Brassica oleracea* L. botanical variety known as collard (*B. oleracea* L. subsp. *oleracea* convar. *acephala* (DC.) Alef. var. *viridis* L.). Collard diversity in this region is found in a varied assortment of landraces held by local gardeners and seed savers who grow and preserve their particular varieties in an

on-farm setting from year to year. Predominantly a fall and winter crop in this region, collard is often the only green planting to be found in the yard or garden of a rural home during the cool season of the year. In spite of the fact that it has been grown widely in the southeastern U.S. since at least the early 1800s, collard has not been the subject of much horticultural study.

The origins of the U.S. collard are uncertain but its ancestors probably came from the Mediterranean where different *B. oleracea* leafy types were domesticated from wild *B. oleracea* before the Roman era (de Candolle 1967; Vavilov 1951). Indeed, *B. oleracea* crop types grouped in convar. *acephala* var. *viridis* are considered the oldest forms of this cultivated species (Diederichsen 2001). Medieval Europeans developed many forms of *B. oleracea* (including broccoli, cauliflower, kale, heading, and non-heading cabbages) and adapted them to soils and climates across Europe. Although heading forms of cabbage became the most popular, gardeners from some areas of the British Isles, Portugal, and Spain developed a loyalty to non-heading types, or coleworts as they were known by the English. The word coleworts may have been altered in the Americas during the 1700s to become "collards" (Drummond 1959; Zohary and Hopf 1993). Cabbages and coleworts were probably introduced to the new world as early as the 1500s and 1600s by the Spanish, Portuguese, and English settlers (Sauer 1993), and by the early 1800s collard was a common garden crop in the region (Davis and Morgan 2005). During the U.S. Civil War, collard gained even more importance as a subsistence vegetable and it remains a symbolic landscape feature and food for many U.S. southerners.

Gladis and Hammer (2001) noted that many races of the *B. oleracea* group can be categorized as neglected and underutilized crops. "Mugnoli", a rare landrace grown in isolated areas of Italy, is an example of such a neglected crop (Laghetti et al. 2005). The economic importance of collard is much greater than a race like "mugnoli"; however, as a relatively unstudied form of *B. oleracea* and source of unique germplasm, it is easily classified as neglected.

According to Mansfeld's Encyclopedia of Agricultural and Horticultural Crops (section by Diederichsen 2001), collard is classified as *B. oleracea* subsp. *oleracea* convar. *acephala* var. *viridis* L. Gladis and Hammer (2001, 2003) have postulated an alternative grouping of all cultivated *B. oleracea* into a subspecies designated "*capitata*". This proposed grouping would keep collard as convar. *acephala* var. *viridis*. Whichever of the above classifications are used, collard remains grouped among other leafy *B. oleracea* vegetables including borecole, cow cabbage, kale, as well as additional ones more common to Europe. This grouping of collard and the European leafy greens is based primarily on morphological similarities and not on any documented genetic similarities.

The evolution of collard as a common vegetable in the southeastern U.S. is not well documented; however, relatively recent genetic studies (Farnham 1996; Song et al. 1988) comparing collard to other *B. oleracea* crops indicate that collard is more closely related to common heading cabbage [*B. oleracea* subsp. *oleracea* convar. *capitata* var. *capitata* L. (Diederichsen 2001)] than to kale. Indeed, cabbage and collard have been grown in close proximity to one another in southeastern states for at least two centuries if not longer, and it is likely that intermating between these two crops was common. On the contrary, kale and nearly all other forms of *B. oleracea* are relatively recent vegetable arrivals to the Southeast and any historical interaction between these and collard is highly unlikely. The genetic studies cited above and anecdotal evidence regarding a close historical relationship between cabbage and collard led Farnham (1996) to suggest that collard might be more appropriately classified with the "*Capitata Group*" rather than the "*Acephala Group*" [as applied by Liberty Hyde Bailey Hortorium (1976)].

Significant commercial production of collard only began in the early 20th century with a large increase in volume in the years following World War II when many southerners left farms in the rural south for urban areas throughout the U.S. Sales of the crop prior to this time were primarily surplus of subsistence production. The advent of supermarkets with attendant warehouse distribution systems provided a reliable market for producers of collard, and these are now the primary outlets for production of this leafy vegetable. At present, the top collard producing states are Georgia (6–8,000 acres), North Carolina (2,800 acres), and South Carolina (2,600 acres). Commercial producers plant a limited number of

cultivars (primarily hybrids) and one hybrid, 'Top Bunch', accounts for the majority of commercial acreage. Due to the predominance of 'Top Bunch', commercial collard is represented by a narrow genetic base.

Apart from commercial production, there is still a significant amount of collard sold directly to consumers in the southeastern U.S. at informal roadside markets, local farmers' markets, and produce stands. These small markets, as well as home gardens in the region, are where unique collard landraces can still be found. These landraces have and are still being perpetuated by a small number of individuals practicing on-farm preservation. Examining less than 10 of these collard landraces in conjunction with other cole crop varieties, Farnham (1996) showed that the landraces represent distinct genotypes and he advocated a systematic collection of them before they are lost.

Today, the typical Carolina on-farm collard "patch" consists of 20–60 plants spaced about 80 cm apart and planted in August. The plants mature in about 70 days and are hardy to about –5°C. The plants reach a height of about 1 m, and mature leaves are various shades of green with hints of blue and yellow. Leaves including petiole can be about 40 cm in length and 20–30 cm wide. The leaves actually taste less bitter if exposed to frost so this makes them ideal for fall and winter greens. When leaves are harvested incrementally over time, the plant's regrowth can provide greens for cooking from November to February. For this reason, collard has long been recognized as one of the cheapest and most productive of garden crops. After plants have been harvested for leaves through the early winter, seed savers allow their plants to stand, and after being vernalized, the plants flower and set seed during spring.

It is likely that genetic variation in the southeastern U.S. collard germplasm pool has declined significantly in recent decades as a few commercial hybrids have been adopted by both commercial growers and home gardeners. Another probable factor contributing to the loss of genetic variation during this same time frame has been a declining number of seed savers throughout the Carolinas and probably the entire Southeast.

From 2003 to 2006, the authors explored the coastal plain region of North and South Carolina in search of collard gardens many which contain traditional landraces. The exploration trips were typically conducted sometime between January 1 and the end of March. During January and February, collard would be easily visible as the primary live plant left in gardens near homes along the rural roads and highways (Fig. 1). Into March or later, the collard patches would usually be blooming and the bright yellow flowers would be easy to spot. Plants left to flower were usually a good indication that a seed saver lived near by. When a plot was found, the owner was sought out, information about the variety being grown was recorded, and seed was requested if it was clear that the variety was not obtained from recent commercial sources. In general, nearly all seed savers were open and happy to discuss their collard varieties and readily gave us some of their seed.

Eighty-eight samples of collard (73 from North Carolina and 15 from South Carolina) were obtained from seed savers during the course of this exploration. These samples were found at diverse locations across the coastal counties of these two states (Fig. 2). In several cases, more than one landrace was obtained at an individual location. The youngest seed saver we encountered was 48-years-old while the oldest was almost 90. More significantly, the vast majority of them were 70 or older. Many of the

Fig. 1 This is a seed saver standing by his collard patch, the only vegetable remaining in his garden during winter months, near his home in Eastern North Carolina

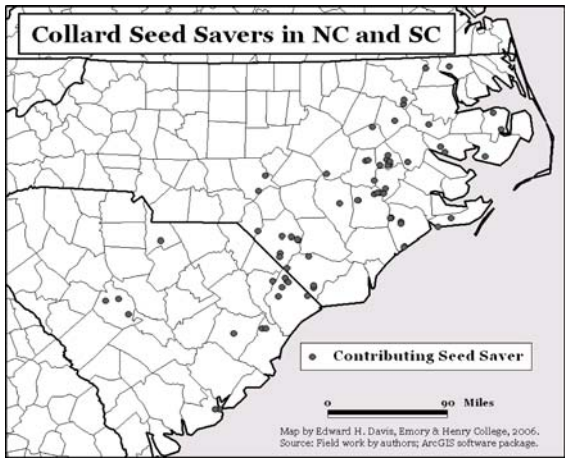

Fig. 2 A map of Eastern North Carolina and South Carolina indicating locations where collard seed savers were found and landrace seed samples were obtained by the authors

elderly seed savers indicated that their landraces could be traced back 2–3 generations; however, we found few indications that these individuals had younger family members interested in maintaining their landraces in the future. We predict that many of the locations sampled the last few years will not be evident within 10 years time. Thus, the exploration described herein has been very timely and has successfully saved *B. oleracea* germplasm that would probably have been lost very soon. Collected samples are now being deposited into the U.S. Plant Introduction Collection of vegetable *Brassicas* held at Geneva, New York for long term preservation.

Examining genetic diversity among several similar collard landraces collected in the mid-1990s, Farnham (1996) concluded that these collard populations likely express unique genes that should prove to be economically important. Clearly, these landraces have been perpetuated in environments with high temperatures and high humidity where several destructive crucifer diseases (e.g., black rot) are prevalent. Further illustrating their potential value, Farnham et al. (2001) showed that a couple of specific collard landraces exhibit partial resistance to Fusarium wilt.

Observations of morphological differences made in un-replicated grow-outs of the most recently collected collard landraces obtained in the exploration described herein indicate that visible and significant diversity exists in this expanded sample of southeastern U.S. collard (Fig. 3). This larger pool

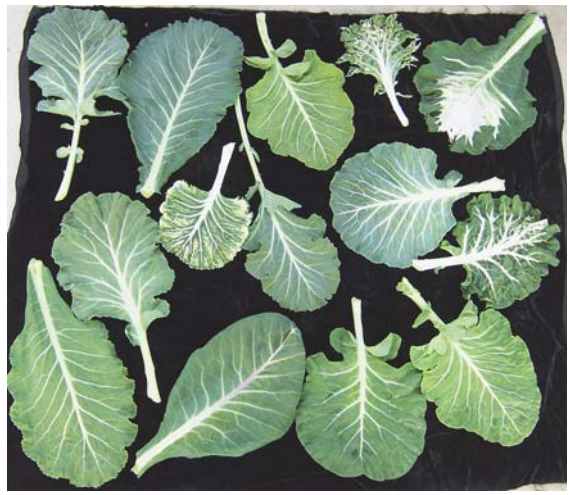

Fig. 3 Collard leaves taken from different field-grown landraces illustrating the variation readily evident in leaf size, shape, and color among the samples obtained during the described exploration

of collard germplasm should prove to be an even more important source of genes for *B. oleracea* improvement than the relatively small pool previously documented.

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